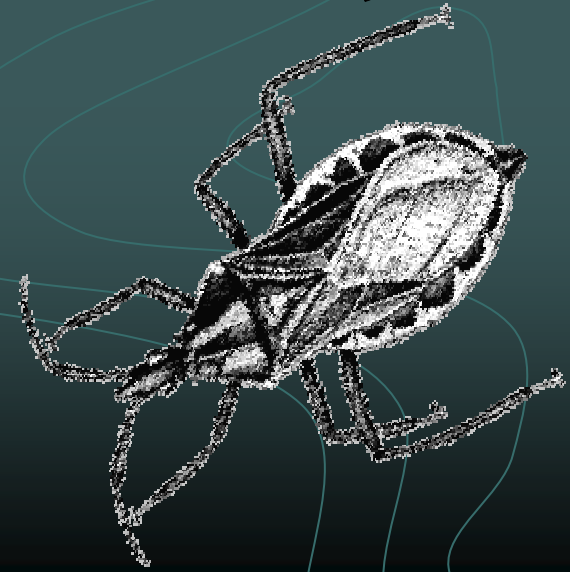


# KISSING BUGS IN ARIZONA

An Overview of Medical Research & Public Health Concern



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# Vital AZ Kissing Bug Issue

Like other blood-sucking insects, the saliva of conenose bugs contains a protein (procalin) that keeps blood from coagulating while feeding. It also contains an anesthetic so the victim does not feel the bite. These foreign substances cause the human immune system to react, sometimes mildly, but sometimes severely.

# Primary AZ Health Issue

If repeatedly bitten, some individuals may develop hyper-sensitivity which can lead to severe allergic or systematic reactions, including anaphylactic shock. Some medical professionals recommend these people keep an epinephrine kit near at hand (including the bedroom).

# Mild Bite Reactions

- when bitten for the first time most people (~95%) simply exhibit reddening, some swelling & itching at the bite site
- however, 1<sup>st</sup> time exposure to the bug's saliva may cause an individual's immune system to become sensitized to the foreign substance
- this can lead to more serious reactions

# Symptoms of Severe Reactions

- ❑ the following is taken from: *Venomous Animals of Arizona* (1992), by Robert L. Smith. UofA Ag Dept: Tucson, pp 38-40 (found at most book stores)
- ☼ 5% of people bitten a second time affected
- ☼ intense itching of the scalp, palms & soles of the feet lasting 30 min.-5 hrs.
- ☼ swelling throughout the body, especially the tongue & throat making speaking, breathing & swallowing difficult for 10-12 hrs.

# Severe Reactions (cont.)

- ✿ some people develop welts & rashes that last for hours - medical intervention is sometimes required
- ✿ other symptoms include nausea, vomiting, body aches, fever, cramps, diarrhea & fainting
- ✿ severity of these symptoms can increase with each successive conenose bug bite once a person has become sensitized (again, usually from the first bite)



# Remember.....

- ⚕ severe allergic reactions to triatome bug bites are not part of the Chagas experience
- ⚕ it is a separate issue “unto itself”
- ⚕ so....a bad reaction does not mean infection with *T. cruzi* and the onset of Chagas’ disease

# U.S. Autochthonous Cases

- (1) 1955: infant, 10 mo., Corpus Christi, Texas (*JAMA* 1955);  
1<sup>st</sup> documented case
- (2) 1955: infant, 5 mo., Bryan, Texas (*Tex Health Bull* 1956)
- (3) 1982: adult, 56 yrs., Lake Don Pedro, Cal. (*JAMA* 1984)
- (4) 1983: infant, 7 mo. (↓), Mathis, Texas (*Tex Preventable Dis News* 1984)
- (5) 1998: infant, 18 mo., Rutherford Co., Tennessee (*IID* 2000)
- (6) 2006: adult, 74 yrs, New Orleans, Louisiana (*EID* 2007)
- (7)? 1988: adult, 49 yrs., Robinson, Texas (*THD comm.*); in  
write-up phase, not on *CDC* list



# In addition.....

- ❖ 1940: experimentally induced infection in a adult volunteer, 24 yrs., Galveston, Texas (*Am J Trop Med* 1943)
- ❖ 2003: megacolon diagnosed in a 1,150 year old human mummy of from the Río Grande Valley, Texas (Mem Oswaldo Cruz 2003) and later confirmed by PCR (unpublished data)
- ❖ lab-related infections (e.g., *Annals Internal Med* 1962)

# General Concern

Many state health departments & and related professional groups are now preparing local health professions for the potential occurrence of imported Chagas' cases in their communities (Louisiana example)



Used with LSMS permission  
Photo courtesy of Dr. Christopher Carlton, Louisiana State  
Arthropod Museum, LSU AgCenter

# Now Reportable In Arizona!

- Administrative Order 2007-01 (Emergency Measures for *Trypanosoma cruzi* infection)
- Issued February 14, 2007 (for 18 months):
- But, soon to become required nationally
- Presented in VBZD-ADHS website:  
<http://www.azdhs.gov/phs/oids/vector/chagas/chagas.htm>

# 9 Native AZ Triatomines

- ✓ *Triatoma rubida* (+): most common species in AZ
- ✓ *Triatoma protracta* (+)
- ✓ *Triatoma recurva* (+): formerly *T. longipes*
- ✓ *Triatoma sangisuga* (+)
- ✓ *Paratritoma hirsuta*
- ✓ *Triatoma neotoma* (+)
- ✓ *Triatoma lecticularia* (+)
- ✓ *Triatoma indictiva*
- ✓ *Triatoma incrassata*

(+): found infected with *T. cruzi* in nature

# How long have we known about Kissing bugs in AZ?

- ✓ Arizona state entomologist A.W. Morrill (1880-1954) wrote about the insects in a paper he published in 1913: “Entomological Pioneering in Arizona”, J Economic Entomology
- ✓ probably bitten by one as he notes “This insect has...been forced upon my observation...”
- ✓ other early entomologists also appear to have mentioned the bug?

# How long have we known about their possible medical significance in AZ?

✿ Again Morrill “implicitly” or indirectly recognized this in a paper given at the 22<sup>nd</sup> Session of the **AZ** Med Assoc held in **Globe** in May 1913, & later published as “Some American Insects and Arachnids Concerned in the Transmission of Disease”, **AZ Med J**(1914)



# From Morrill (1914)

- notes medical problems (i.e., systematic reactions) associated with the bug's bite
- also acknowledges Chagas' discovery: "...it should be noted that a member of the same genus as our south-western 'cone-nose' has been recently proven to be the only important carrier of a South American disease known as Barbiero fever."
- at least an implicit suggestion of "if there, then why not here?"

# A 1925 misunderstanding

- ✓ Ira P. Bartle (1925) Trypanosomiasis. NW Med 24 (11):561-562
- ✓ Views “trypanosomiasis” in the Nogales area as an “**African Sleeping Sickness-like disease**”. Actually refers to it as “**Brazilian sleeping sickness**” and Chagas’ Disease.
- ✓ He’s probably looking at cases of encephalitis, but not Chagas’ Disease

# U of A Annual Report 1943

- ✓ notes triatomines “always attacking sleeping persons to some extent in early summer”
- ✓ notes recent problems with bugs at Montezuma Castle & Tuzigoot National Monument
- ✓ notes often associated w/wood rat nest so ...  
“keep wood rats cleared out of the immediate vicinity (radius of 200 yard) of the dwelling house. This may be readily accomplished by the use of ordinary (snap) rat traps.”

Have AZ triatome bugs even been shown to be infected with *T. cruzi* & , if so, how long have we known this?

- ✓ YES!
- ✓ first reported in 1936 by Kofid & Whittaker (J. Parasitology)
- ✓ 7/79 (9%) specimens from Tucson infected
- ✓ positives collected from houses and from beds

# And.....

- ✓ Wood 1939, 1940, 1941: combined total of 515 collected from Congress (Yavapai Co.) area w/28 (5.4%) infected
- ✓ Bice 1964 (U of A thesis & Rev Biol Trop): 657 collected from Tucson area w/65 (10%) infected



# Have we ever had buildings just as conducive for bug invasions/infestations as in Central & South America?

- ✓ You bet!!!
- ✓ AZ had domestic & domicile habitats capable of maintaining triatome bug infestations both prehistorically, historically (but now?).



# How about behavior increasing risk of bug bites & exposures?

- ✓ before evaporative coolers & air conditioning it was common for people to sleep outside during the summer “where insects would have easy access to them”
- ✓ in Tucson beds were often seen near wood rat nests
- ✓ mentioned by Wood & Wood (1938: 211)

# So, have we ever documented native conenose bugs causing Chagas' disease in Arizona?

- ❖ basically, no -- there are no documented human autochthonous (indigenous) cases in the state
- ❖ this does not mean it's impossible
- ❖ however, there is some evidence that must be acknowledged.....

# Wood (1941)

Superintendent Alvarado Mine, Congress, AZ  
remembered:

“...one case of a man...forced to leave...the mine  
because of a swollen face, especially swollen eyes.”

But this isn't good evidence as periorcular &  
palpebral edema not bilateral; however, it probably  
represents an allergic reaction.

# Controversial 1970s U of A Study

Thomas Betz (1978) Conflicts in the Study of Chagas' Disease Between a SW Indian Population and the Staff of a SW University College of Medicine. In: *The Anthropology of Health*, pp. 88-94. St. Louis: C.V. Mosby Co.

# Betz (1978)

- ✓ concerns medical ethics and controversy associated with a study of Chagas' disease in AZ Indians
- ✓ no specific id. of the groups involved
- ✓ mentions that in 1974 the blood sera of 19/452 N.A. individuals tested positive for *T. cruzi* via complement fixation tests
- ✓ comp. fix. thought at that time 95 % accurate - findings therefore substantial

# Betz (1978) continued

- ✚ further investigation revealed that some of the serologies may have been incorrectly interpreted as positive
- ✚ in March 1975 five additional patients were found
- ✚ the study went through many deaths & rebirths but finally died in late 1977



# The Conundrum

*T. cruzi* in AZ triatome bugs & small mammals

+

habits & habitats putting people at risk of infection

○ human Chagas' cases

HOW? WHY?

# Main Reason

Our triatome species are not good vectors of *T. cruzi* as they don't generally defecate while they are feeding.

How Do We know this?  
Where did this idea come from?

It was first reported by Dr.  
Sherwin Wood in 1951 &  
again in 1954 and 1960

# Wood's 1951 Data (J Econ Entomol 44:52-54)

- ✓ observed defecation times (up to 1-8 times over 3-5 hr period) for 4 different adult species by sex and room temperature; all fully engorged after feeding on a guinea pig (feeding times ranged from 2:50 to 29:10)

- ✓ *T. protracta*: 1<sup>st</sup> def (10) 31:01; range 0.10 - 133  
2<sup>nd</sup> def (9) 44:55; range 7 - 125
- ✓ *T. rubida*: 1<sup>st</sup> def (5) 2:02; range 0.10 - 6  
2<sup>nd</sup> def (5) 12:0; range 7 - 23

# Wood's 1951 Data (continued)

- ✓ *T. recurva*: 1<sup>st</sup> def (3) 76:07; range 32 ~ 132  
2<sup>nd</sup> def (2) 48:50; range 32 ~ 65
- ✓ *P. hirsuta*: 1<sup>st</sup> def (2) 35:0; range 25 ~ 45  
2<sup>nd</sup> def (2) 42:50; range 40 ~ 45
- ✓ *T. rubida* best candidate for vector

## Wood's 1954 Data (Exper Parasit 3:227-33)

- ✓ 7 ♂ & 7 ♀ adult *T. protracta* used to study metacyclic and non-metacyclic trypanosoma parasites; 5 days after initial infective blood meal, bugs feed again every day for upwards of 16 days or more
- ✓ ♂s didn't defecate as often or as regularly as ♀s (but ♀ rates not given)



## Wood's 1960 Data (Exper Parasit 10:356-65)

- ✓ Combo of the 1951 & 1954 research using 17 adults (9♂s & 8♀s) & 50 nymphs (13 second instar, 8 third instar, 14 fourth instar, & 15 fifth instar); all *T.p. protracta*, except 4 nymphs *T.p. woodi*
- ✓ up to 7 defecations in a 6 hr period for adults
- ✓ ♂s: 1<sup>st</sup> def 53:09 (16); range 6 - 300  
2<sup>nd</sup> def 90:08 (12); range 26 - 344
- ✓ ♀s: 1<sup>st</sup> def 50:0 (10); range 1 - 98  
2<sup>nd</sup> def 136:33 (9); range 55 - 346

## Wood's 1960 Data (continued)

- ✓ up to 15 defecations in a 6 hr period for nymphs
- ✓ 2<sup>nd</sup> instar: 1<sup>st</sup> def 59:54 (13); range 0 - 254  
2<sup>nd</sup> def 85:36 (11); range 3 - 324
- ✓ 3<sup>rd</sup> instar: 1<sup>st</sup> def 22:25 (8); range 5 - 87  
2<sup>nd</sup> def 57:0 (7); range 6 - 127
- ✓ 4<sup>th</sup> instar: 1<sup>st</sup> def 37:0 (14); range 7 - 85  
2<sup>nd</sup> def 79:32 (13); range 14 - 284
- ✓ 5<sup>th</sup> instar: 1<sup>st</sup> def 18:06 (15); range 2 - 48  
2<sup>nd</sup> def 48:06 (15); range 13 - 344

# 5 Additional Reasons Offered by Wood (1976)

- ✓ infrequent contacts w/infected bugs due to housing with screening of doors and windows
- ✓ exposure to smaller contaminative droplets w/fewer infective parasites per unit volume of feces
- ✓ rapid evaporation of infected bug feces from skin in hot weather
- ✓ shorter feeding times
- ✓ rapid dispersal from the host after feeding

# Closing Comments

- ✓ Some authors think that -- (1) feeding-defecation explanation is speculation; (2) not much known about *T. cruzi*-*Triatomae*-*Neotomae* (pack rats)-human interactions
  - (1) Wood's 1951, 1954, & 1960 work not "speculation"
  - (2) lots of work done in this field; but more research needed

# Yes, More Research Needed!

- ✓ Need defecation times of AZ populations, especially *T. rubida* & *sanguisuga* adults & nymphs; Wood's work involved California specimens (are there differences?)
- ✓ Need better clarification of species distributions in and around other AZ communities (most work involves Tucson and Congress-Alvarado Mine; Wood has also looked at bugs from Casa Grande, Continental & Nogales)
- ✓ *T. cruzi* species/virulence differences?

# Have we changed our “endemic” message in light of 21<sup>st</sup> Century Chagas’ disease concerns?

- ✓ No, not really.....
- ✓ “No [confirmed] cases have been reported in Arizona but in view of the endemicity of ...[*T. cruzi*] infection in mammalian reservoirs and the constant presence of the vector in the vicinity of many homes, physicians should keep the possibility of ...[Chagas’]... in mind.”
- ✓ From: H.H. Smith’s article in *AZ Med* vol. 17, no. 1, page 4
- ✓ January 1960!